

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE WEST VIRGINIA GEOLOGICAL SURVEY;
I. C. WHITE, STATE GEOLOGIST.

SOIL SURVEY OF WEBSTER COUNTY, WEST VIRGINIA.

BY

CHARLES N. MOONEY.

W. EDWARD HEARN, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1918.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1920.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., July 31, 1919.

SIR: In the extension of the soil survey in the State of West Virginia during the field season of 1918 a survey was undertaken in Webster County. This work was done in cooperation with the West Virginia Geological Survey.

I have the honor to transmit herewith the manuscript report and map covering this work and to request their publication as advance sheets of Field Operations of the Bureau of Soils for 1918, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

CONTENTS.

	Page.
SOIL SURVEY OF WEBSTER COUNTY, WEST VIRGINIA. BY CHARLES N.	
MOONEY -----	5
Description of the area-----	5
Climate -----	8
Agriculture -----	9
Soils-----	12
Dekalb stony silt loam-----	15
Dekalb silt loam-----	16
Upshur stony silty clay loam-----	18
Pope sandy loam-----	20
Moshannon fine sandy loam-----	21
Atkins silt loam-----	22
Rough stony land -----	22
Summary-----	23

ILLUSTRATIONS.

FIGURE.	Page.
FIG. 1. Sketch map showing location of the Webster County area, West Virginia -----	5

MAP.

Soil map, Webster County sheet, West Virginia.

SOIL SURVEY OF WEBSTER COUNTY, WEST VIRGINIA.

By CHARLES N. MOONEY.—Area Inspected by W. EDWARD HEARN.

DESCRIPTION OF THE AREA.

Webster County, W. Va., is situated in the central part of the State. Webster Springs, the county seat, is about 100 miles directly south of Clarksburg and about the same distance east of Charleston. The county comprises an area of 558 square miles, or 357,120 acres.

Webster County lies in the Allegheny Plateau section of the Appalachian province, the eastern county boundary being only a short distance from the Allegheny escarpment. The surface is that of a deeply dissected elevated plateau. The general level of the ridge crests is about 1,800 feet above sea level on the south side of the Little Kanawha River, which separates Webster County from Lewis and Upshur Counties. To the southeast the general level rises until on the eastern and southeastern boundaries the elevation is 3,800 to 3,900 feet, with numerous knobs rising above the general plateau level. The northwestern half of the county is marked by narrow mountainous ridges and numerous spurs traversed by a network of streams. The ridges almost without exception have steep slopes to narrow, V-shaped valleys, whose floors lie 1,000 to 1,500 feet below the crests. To the southeast the ridges become broader and the crests more rolling or dome-shaped. This is true of Point Mountain between the Elk River and its Back Fork, of the Gauley Divide between Elk and Gauley Rivers, of the divide between Gauley and Williams Rivers known as Turkey Mountain, and of Cranberry Mountain between Williams and Cranberry Rivers. While all the slopes are very steep, there is very little rugged or precipitous topography until the Elk River is reached, the slopes usually being smooth and only occasionally marked by outcropping ledges of rock, though covered with small stones.

The mountain slopes along the upper courses of the Gauley River and Williams River are rough and rugged, while along the upper

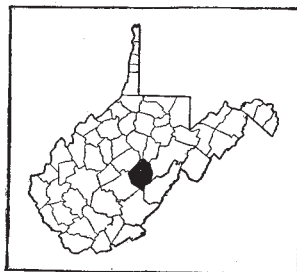


FIG. 1.—Sketch map showing location of the Webster County area, West Virginia.

course of Cranberry River the valley walls are formed by outcrops of sandstone forming precipitous cliffs to the very tops of the ridges.

On the broader of these sandstone ridges there occur flat or nearly flat areas known as "glades," the more even surface being due to the resistance of the underlying rock to erosion. The smoothest part of the county is in the glade district in the vicinity of Cowen, at an elevation of over 2,000 feet. Here the surface is rolling, with smooth, gentle slopes and some short, narrow ridge crests. This smooth topography is due to the presence of shales and the absence of thick sandstone strata.

The valleys of the main streams in this more mountainous part of the county are wider than elsewhere in the county, and low terraces occur along the streams, especially on the Elk, Gauley, and Williams Rivers. The Elk River has cut the deepest valley, having carved through the resistant formations that the other rivers to the south have not penetrated, and reached down through the underlying softer red shales and sandstones. These various valleys are from 1,000 to 2,500 feet below the ridge crests.

The lowest elevation in the county is at the point where the Elk River leaves the western border, near Centralia (Braxton County), the elevation being 950 feet above sea level. Where the Elk River enters the eastern border, at Whitaker Falls, the elevation is about 2,200 feet. The Little Kanawha River leaves the county at an elevation of about 1,000 feet above tide level. The valleys of the Gauley, Williams, and Cranberry Rivers lie at a much higher elevation than that of the Elk. At the point where Williams River joins the Gauley River the elevation is 2,200 feet, nearly 700 feet higher than the Elk River at Webster Springs, only a few miles away. The highest elevations are on the mountain crests in the eastern and southeastern parts of the county. On Point Mountain the elevation near the Randolph County line is 3,700 feet above sea level, and to the south, on Redoak Knob and Turkey Mountain, 3,900 feet. Similar elevations are attained on numerous points near the Randolph and Pocahontas County lines. The extreme range in elevation within the county is approximately 3,000 feet.

Webster County is drained into the Ohio River through a number of streams. The Little Kanawha River, forming a part of the north boundary of the county, empties into the Ohio River at Parkersburg. It has a few small tributaries in Webster County. The larger part of the county is drained by the Elk River and its tributaries, itself a tributary of the Great Kanawha. The Elk River flows through the central part of the county from the east, turning north, and finally west. The Gauley River and its tributaries, Williams and Cranberry Rivers, drain the higher mountainous southern part of the county.

All the streams are fed by numerous mountain branches, and they all have their headwaters in the higher mountainous section to the east in Randolph, Pocahontas, and Greenbrier Counties.

The streams of Webster County are all swift-flowing mountain streams, noted for the clearness of their waters. They flow over rocky or pebbly floors, and many of them have rapids, with occasional low cascades and intervening still, deep pools. The surface configuration of the county favors very rapid run-off, but this is held much in check by the extensive forest cover. Nevertheless, the streams rise rapidly to high stages and do much damage in the agriculturally developed valleys along their lower courses. Aside from the high waters, which would be hard to control, these streams afford great opportunity for the development of water power.

Webster County was formed from parts of Randolph, Nicholas, and Braxton Counties in 1860. Permanent settlement took place soon after the Revolutionary War, before which time the region was explored by hunters, some of whom established temporary homes. The early settlers came mostly from other counties of Virginia. Later settlers came from Pennsylvania and Maryland. The present population consists largely of descendants of these early settlers, many of them retaining the old homesteads. In recent years, with the opening of coal mines and the removal of the timber, immigrants from other parts of the country and from foreign countries have been attracted to the county. It is still sparsely settled, the population being mainly confined to the valleys, especially the Holly, Elk, Gauley, and Williams Valleys, which were the first areas settled. There are scattered homes on the mountain tops, especially on Point Mountain, and the Gauley Divide. According to the census the population of Webster County in 1910 was 9,680, all of which is classed as rural. The largest town in the county is Webster Springs, the county seat, located centrally on the Elk River. In 1910 it had a population of 500. Other towns include Erbacon, Wainville, Cowen, and Camden on Gauley, all of which are on the Baltimore & Ohio Railroad in the western part of the county. Diana is on the West Virginia Midland Railroad, and Hacker Valley, in the northern part of the county, on the Pickens & Hacker Valley Railroad. Small trading settlements are scattered over the county.

The main transportation line in the county is the Richwood Branch of the Baltimore & Ohio Railroad, which passes through the western part of the county, connecting Richwood in Nicholas County with the main line at Clarksburg. Another railroad, a narrow gauge, connects with the Baltimore & Ohio Railroad at Holly Junction, in Braxton County, following the valley of the Holly River and crossing a divide of Elk Mountain in the Elk River Valley, reaching

Webster Springs 31 miles distant from Holly Junction. There are a number of timber railroads in the county, both standard and narrow gauge, which carry freight and passengers.

County roads reach all the main settlements. The highways are usually not well kept, but some of the main roads are being widened and established on better grades, as between Camden on Gauley, Cowen, and Webster Springs, and Point Mountain, where this road connects with an improved road in Randolph County. This is to be a class A road, or State highway. There are numerous trails over the mountains and valleys. Telephone service reaches most parts of the county, largely to serve the lumber interests and as a measure of forest-fire protection.

Practically no agricultural products except live stock reach markets outside the county, there being a market for all other farm produce at the mines and lumber camps. The principal products shipped out of the county are lumber and coal.

CLIMATE.

There is no Weather Bureau station in Webster County, but the records of the station at Pickens, in Randolph County, which extend over a period of 15 years, represent climatic conditions in Webster County fairly well. The Pickens station has an elevation of 2,699 feet and the data given are especially applicable to the more elevated parts of Webster County.

Webster County has a moderately cool and temperate climate. The mean annual temperature as recorded at Pickens is 49.2° F. The summers are pleasant, with usually cool nights, and hot spells are of short duration. At Pickens a maximum temperature of 96° has been recorded in June and July, but this temperature is probably exceeded a few degrees in the valleys. The mean temperature for the summer months is 64.5°. The winters are rather cold and attended by heavy snowfalls. The mean temperature for the season is 31.7° F., and the temperature during the winter months frequently falls below zero. The lowest temperature on record is -24° F., recorded in February.

The mean annual precipitation is 60.9 inches. This is well distributed throughout the year, the least rainfall occurring from August to November. Droughts of short duration often occur during the growing season. The average fall of snow at Pickens is 89.6 inches.

The average date of the last killing frost in the spring is given as May 9, and the average date of the earliest in the fall as October 12. The latest recorded killing frost in the spring occurred May 29, and the earliest in the fall, on September 19. Light frosts have occurred in all the summer months in depressions on the

mountain tops, and they may do some damage to crops. The growing season is rather short, especially for corn, the season not being long enough to mature corn on the higher ridges. In the valleys, however, and on the mountain slopes where there is good air drainage corn can be grown. Such crops as potatoes and buckwheat do well at the higher elevations.

The following table, compiled from the records of a Weather Bureau observer at Pickens, shows the normal monthly, seasonal, and annual temperature and precipitation:

Normal monthly, seasonal, and annual temperature and precipitation at Pickens, Randolph County.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year, 1879.	Total amount for the wettest year, 1907.	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December.....	32.3	72	-13	5.03	6.44	4.45	18.6
January.....	31.1	72	-16	6.50	3.13	11.54	22.6
February.....	31.8	72	-24	4.85	3.15	4.83	17.5
Winter.....	31.7	72	-24	16.38	12.72	20.82	58.7
March.....	39.6	87	- 4	5.39	5.48	7.10	9.5
April.....	48.5	87	8	5.10	1.09	6.66	12.2
May.....	58.9	95	23	5.00	3.70	3.84	0.4
Spring.....	49.0	95	- 4	15.49	10.27	17.60	22.1
June.....	57.9	96	33	6.16	4.57	8.69	T.
July.....	68.8	96	38	6.35	6.13	13.36	0
August.....	66.9	92	39	4.99	3.64	6.83	0
Summer.....	64.5	96	33	17.50	14.34	28.88	T.
September.....	61.9	94	30	3.84	2.63	3.43	0
October.....	52	88	14	3.82	1.64	4.71	1.0
November.....	40.6	79	0	3.88	3.07	5.42	7.8
Fall.....	51.5	94	0	11.54	7.34	13.56	8.8
Year.....	49.2	96	-24	60.91	44.67	80.86	89.6

AGRICULTURE.

The early settlers in Webster County were attracted by the abundance of wild game, which was plentiful until comparatively recent years. The pioneers were remote from markets and transportation facilities, and grew subsistence crops of corn, small grains, and vegetables. They hunted and trapped for their meat, and furs formed their only source of income. This condition continued to within the last 30 years. About 1900 the Richwood branch of

the Baltimore & Ohio Railroad reached Flat Woods and Sutton, in the adjoining county of Braxton, and extended to Richwood. This opened up transportation, and the development of the timber resources of the county began. Narrow-gauge lumber roads as feeders began building up the valleys. By 1902 the narrow-gauge railroad now known as the West Virginia Midland was constructed to Webster Springs, following up the Holly River Valley and crossing Elk Mountain into the Elk Valley. This line was built to haul lumber and to carry tourists visiting the salt sulphur springs at Webster Springs. It was continued up the Back Fork of Elk River to connect with a similar road extending to Pickens, in Randolph County. In recent years a standard-gauge lumber railroad has been in operation along the Cranberry River. Here large tracts of forest have already been cut over. At present lumbering is probably the most important industry in the county. Some coal is mined along the Baltimore & Ohio Railroad, and a few mines in other places serve local needs. The agriculture consists of general farming combined with some stock raising. The products of the farm, except the live stock, do not meet the local demands, much of the subsistence supplies for the lumber camps being purchased outside the county.

Corn is the principal cultivated crop. It is grown for home use and for feeding live stock, but the production ordinarily is insufficient. In 1909, according to the census, 5,698 acres were in corn, producing 117,851 bushels. In 1899 the area devoted to corn was 6,149 acres, which produced 109,020 bushels. In 1889, 4,457 acres were planted to corn, and in 1879, 2,896 acres.

In these earlier years there was a correspondingly larger acreage in the small grains. In 1879 wheat held the leading place among the small grains, occupying 626 acres. The area in oats was 578 acres. By 1889 oats had increased to 1,163 acres, and wheat to 957 acres. In later years the acreage of these crops has shown a considerable decrease, oats being grown on only 598 acres in 1909 and wheat on 27 acres. The acreage released from small grain has been put in grass, as the acreage in corn does not show a corresponding increase. At present (1918), owing to the great demand for wheat, the crop is being grown much more extensively. Most of the oat crop is cut green and fed in the sheaf.

A small acreage has been devoted to rye at each census period. In 1909 buckwheat was grown on 53 acres, as compared with 72 acres in 1899. Buckwheat is grown in small patches on most of the farms.

The largest acreage, approximately equaling that of all other crops combined, is in grass. In 1909 the area devoted to tame or cultivated grasses was 8,462 acres and the production 5,202 tons, or a little over one-half ton to the acre. Of this total, 6,439 acres was in timothy and clover mixed. Timothy also is grown alone on a rela-

tively large acreage, and there is a small acreage devoted to millet or Hungarian grass. A considerable part of the rougher, steep, and stony slopes is necessarily in permanent pasture.

Among the minor crops of the county are potatoes, occupying 394 acres, with a production of 38,699 bushels in 1909; beans grown on 128 acres in 1909, with a production of 883 bushels, and sorghum grown in patches on most farms for the making of sirup.

Tree fruits, especially apples, are grown throughout the county, but not on a commercial scale. Apples of excellent color and flavor can be produced, but the grade is low, as no spraying is done and in general very little care is given the orchards.

Cattle and sheep raising are the most important of the live stock interests. Dairying is carried on only to a sufficient extent to produce milk for family use and some butter for sale in the towns. Considerable numbers of beef cattle are raised, being kept on the rough pastures or allowed to range in the woods. This stock is almost exclusively of the Hereford breed, which seems to be suited to the condition of the range in this county. The hay produced is used for the winter feeding of the cattle and the few horses kept. Corn fodder also is used for this purpose, and some grain is fed, but many farmers buy shipped-in hay and grain, especially for the milch cows.

There are considerable numbers of sheep kept in Webster County. These are of the coarse-wool and mutton breeds; the production of wool is the main object. In 1909 the value of the wool clip amounted to \$8,288.

A few hogs are found on most of the farms. As a rule enough corn is grown to fatten the hogs raised. Some hogs are allowed to run on the open forest range, where in the fall they get plenty of mast. Poultry forms a considerable source of income. The value of the poultry and eggs sold in 1909, according to the census, amounted to \$28,092.

The bottom-land soils of this county are recognized as best adapted to the general farm crops, because of the ease of cultivation and the better moisture conditions. Crops in the bottom-land areas, however, are more likely to suffer from unseasonable frosts. Of the upland soils the "red clay land" (Upshur stony silty clay loam) is considered to be the most productive, and a stronger soil for grass than the other types.

As the fields are small and the slopes rather steep and stony, the more improved types of farm implements can not be used in this region. Much of the cultivation is necessarily done with hoes and the hay crops often have to be cut with the scythe. On the bottom lands horse-drawn cultivators and mowing machines are used. It is the general practice in this county to let the grass crop stand until it is ripe and the seed has fallen before cutting it for hay. This is

for the purpose of keeping the mowing lands seeded, but the hay is consequently of poor quality, being tough and woody. It would be better to plow up the sod as soon as it begins to run out, plant a cultivated crop, and then reseed to grass.

No regular system of crop rotation is followed in this county. Corn or some other cultivated crop may be grown for a few years before the land is reseeded to oats and grass; then hay is cut for an indefinite number of years before the sod is plowed.

The equipment on the farms varies greatly, and depends largely on the topography. On some of the better farms the buildings and equipment are good, but the rougher farms have only poor equipment, with small houses and outbuildings. On the whole, for a mountainous county, the dwellings may be considered good. Many of them are two stories in height and are kept painted, but the barns as a rule are small and the provision for housing stock, especially cattle, inadequate.

Little barnyard manure is made on the farms, since the stock is not confined. The manure that is available is applied to the handiest fields on the bottom lands and to the vegetable gardens. A small but increasing quantity of commercial fertilizer is used, the expenditure in 1909, as reported by the census, being only \$1,311, or \$12.72 for each of the 103 farms reporting. At the present time the fertilizer used is of low grade, containing only a small percentage of nitrogen and potash. Liming has been tried by a few farmers.

As the farms are small, there is practically no hired labor necessary except at hoeing time, and the work is done largely by the farmer and his family. Labor is scarce, practically all the laborers available being employed in lumbering and mining.

Land holdings in Webster County vary from farms a few acres in size to large tracts held by companies or individuals interested in lumbering. In 1910 the total number of farms was 1,084, comprising 29.2 per cent of the area of the county. The average size of the farms is given as 100.6 acres, of which 35.2 per cent, or 35.4 acres per farm, is improved. The census reports 79.7 per cent of the farms operated by owners, 20.2 per cent by tenants, and 0.1 per cent by managers.

The value of farm land ranges from \$20 to \$50 or more an acre, depending largely upon the character of the land and the nearness to towns. The higher prices are commanded by upland farms that include some bottom land.

SOILS.

Webster County lies wholly in the Allegheny Plateau division of the Appalachian Mountain and Plateau soil province. Excluding Rough stony land, six types of soil are mapped, three of them residual

and three alluvial. The residual or upland soils have been derived from the weathering of underlying rocks of Carboniferous age, consisting of interbedded sandstones and shales, with included beds of fire clay and seams of coal. The sandstones vary from thin bedded or shaly to massive, with fine-grained to coarse conglomerates, and range from gray to red in color. The shales vary from sandy to argillaceous or clayey, and in color from gray, greenish, or olive to red and Indian red. With some exceptions, the shale strata are thin, and sandstone predominates over most of the county. Owing to the formation of huge folds in past geologic upheavals and to subsequent erosion, as well as to the general rise of the formations to the southeast, about 2,500 feet of the underlying strata are exposed in this county. The youngest and highest of these is the Conemaugh formation, only the lower part of which is present, capping the highest points in the western and northwestern parts of the county. It is composed of gray sandstones and shales, the shales predominating and giving rise to a silty soil, with smooth, rounded topography and practically without stone, the processes of weathering have been quite complete. Beneath the Conemaugh and occupying the same general region lies the Allegheny formation, which attains a thickness of 300 feet in this county. It is composed of the same kinds of rocks as the Conemaugh, but the proportion of sandstone is greater and the topography is steeper and rougher and the soils more stony. Below the Allegheny is the Pottsville series, including its two divisions, the Kanawha group, and New River group. The Kanawha group has a thickness of 950 feet exposed in this county and the New River an exposure of 650 feet. The Pottsville series makes up the larger part of the county. Sandstones are especially predominant, and some of them are conglomeritic. The Pottsville gives rise to stony soils. Toward the southeast the sandstone strata increase in thickness and give rise to areas so rough and stony as to be classed as Rough stony land. In the southwestern part of the county, however, in the glade district, the beds have changed from sandstone to shale beds, forming a smooth, hilly topography and giving rise to a silty soil similar to that formed from the Conemaugh formation.

Below the Pottsville is the Mauch Chunk formation, consisting mostly of red shales and sandstones. The red color contrasts strongly with the gray, brown, and yellow colors of the other formations. The Mauch Chunk formation is exposed in the walls of the Elk River Valley, where its thickness is between 500 and 600 feet. It is exposed sparingly in the Gauley River Valley and the upper part of the Williams River Valley, but for the most part it is covered by detritus from formations above. Underlying the Mauch Chunk, the Greenbrier limestone, or mountain limestone, outcrops in the bed of

the Elk River near Webster Springs, but it has had no influence on the soils.

The nature of the underlying rocks is important as affecting the topography of the country as well as the character of the soils and the trend of agriculture. Areas underlain mostly by shales are smooth, though the slopes may be steep. When sandstone predominates, as is the case throughout most of Webster County, the slopes are not only steep, but considerable stone remains on the surface, and where the beds are thick or massive cliffs or rough stony areas are encountered.

The upland soils are grouped into two series, the Dekalb and Upshur. The Dekalb soils have been derived from gray sandstones and shales, and are characterized by a gray to light-brown color, with brownish-yellow to yellow subsoils. They are well drained, and are of moderate productiveness. Two types occur in this county, the stony silt loam and the silt loam, the former the most extensive type in the county.

The types in the Upshur series are characterized by dark-red or Indian-red surface soils and subsoils. The members of this series have been derived from red shales and sandstones, which in Webster County are correlated with the Mauch Chunk formation. They occur on the lower mountain slopes along the valley of Elk River. Only one type of the Upshur series, the stony silty clay loam, occurs in Webster County.

The alluvial or first-bottom soils belong to three different series, separated largely upon the basis of color and drainage. They mainly represent sediments carried down by the streams from the upland and deposited in their flood plains, but include as well some wash from the adjacent slopes. The material varies in character and color, depending upon its source. The Pope series is characterized by a brownish-gray soil and a brownish-yellow subsoil. The Moshannon series is characterized by a brownish-red or dark-red surface soil and a dark-red or Indian-red subsoil, the material being derived from the Upshur soil of the upland. The Atkins series is characterized by a brownish-drab surface soil and a drab subsoil, the color being due to poor drainage.

The distribution of the different soil types of Webster County is shown on the accompanying map, the base for which was supplied by United States Geological Survey topographic sheets, made in cooperation with the West Virginia Geological Survey. The actual and relative extent of the different soils is given in the following table:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Dekalb stony silt loam.....	236,992	66.4	Moshannon fine sandy loam.....	2,176	0.6
Rough stony land.....	78,144	21.9	Atkins silt loam.....	1,216	.3
Dekalb silt loam.....	23,808	6.7	Total.....	357,120
Pope sandy loam.....	7,552	2.1			
Upshur stony silty clay loam.....	7,232	2.0			

DEKALB STONY SILT LOAM.

The surface soil of the Dekalb stony silt loam is a brownish-gray, friable stony silt loam, 2 to 4 inches in depth, underlain by a sub-surface layer of about 4 inches of yellowish-gray to yellow silt loam to silty clay loam. The subsoil is a yellow stony silty clay loam. Fragments of sandstone and shale are scattered over the surface and throughout the 3-foot section in varying quantities, the proportion increasing with depth. In many places the disintegrated bedrock is encountered within 3 feet of the surface.

The proportion of sandstone and shale varies from place to place. The sandstone fragments vary in size from small pieces to large stones and boulders. Some outcropping ledges of bedrock appear, but the outcrops usually are too small and scattered to affect the agricultural value of the land. There are included in the type some small areas of stony loam and sandy loam, occupying for the most part narrow strips on steep slopes. The stony loam areas contain a large percentage of small shaly sandstone fragments and are locally called "gravelly land."

The Dekalb stony silt loam is by far the most extensive soil in Webster County. It covers large, almost uninterrupted areas in all sections, occupying both the slopes of the ridges and mountains and their crests. For the most part the slopes are steep and difficult to cultivate. The crests of the higher, broader mountain tops are flat to dome shaped, and are favorable for farming except in the difficulty of access. The type has good surface and internal drainage. The slopes are subject to gullyng, and the lighter silty surface soil on the steep slopes is soon removed.

Only a small proportion of this soil has been cleared and placed under cultivation. The cultivated areas are scattered, and largely confined to the lower slopes and tops of the ridges and mountains. The soil supports a great variety of trees, practically all those occurring in this region. Oak, chestnut, maple, poplar, beech, birch, hemlock, and spruce are the predominating species. The poplar and maple prefer the north slopes and the ravines and coves. Chestnut predominates in places, especially in the lighter textured and more stony areas.

Corn is the most important crop on this soil. The crop on the slopes is less likely to injury from frosts and is better supplied with moisture than on the tops of the mountains. Areas in the coves are especially suitable for corn, which is considered even a more certain crop here than in the bottom lands. The yields range from 15 to 40 bushels or more per acre. Some small grain, principally oats and wheat, are grown. Part of the cleared area, where very stony or very steep, is in permanent pasture. Timothy and clover, mixed, is the principal hay crop. Orchard grass does well, but makes a rather coarse hay, especially if cut late. Buckwheat is a valuable crop for the higher elevations. Potatoes do well at all elevations, except where the soil is so steep as to wash badly.

Only the lightest of farm implements can be used on this soil. The one-horse plow is employed to break the land, and crops are largely cultivated with the hoe. The hay and grain crops are generally harvested with the scythe and cradle. Owing to the difficulty of hauling, very little barnyard manure is used on this soil, and after a few seasons' cultivation it is seeded with grass, the heavy surface soil having largely been removed by wash.

The price of land of the Dekalb stony silt loam ranges from \$10 to \$50 an acre. The heavily timbered areas command a higher price than the cleared areas.

DEKALB SILT LOAM.

The surface soil of the Dekalb silt loam consists of two layers, an upper layer of brownish-gray or light-gray, and in places brown, silt loam, 3 to 6 inches thick, and a lower layer, a few inches thick, of yellowish-gray to light-yellow silt loam or silty clay loam. The subsoil is a yellow silty clay loam in most places extending to 36 inches or more and generally thoroughly weathered to that depth. When plowed, enough of the heavier subsurface and subsoil material is brought to the surface to make the soil a silty clay loam in texture. In general the type is free from stones, though in small patches where sandstone or shale fragments remain from some out-cropping ledge, some stones occur. As the type approaches the Dekalb stony silt loam there are more stones present and the bedrock is encountered within the 3-foot section.

Some variations occur in this type, depending upon the formation from which it has been derived. Where sandstone predominates the soil is more silty or even loamy in texture, while areas in which shale is the source of origin are more silty or clayey, often being a silty clay loam, especially when the shale is argillaceous. In some places fire-clay appears at the surface, giving the soil a rather stiff, plastic structure.

The largest development of the Dekalb silt loam is in the southwestern part of the county in the glade district, extending from the

vicinity of Cowen and Camden on Gauley west to the Nicholas County line. In this section the formation of this soil is due to the thinning out of the sandstones and the predominance of shales. To the east the sandstones gradually come in again, as is indicated by the presence of stones on the surface. The rest of the type lies on the crests of the ridges from the above-mentioned area northeast to the Lewis County line, occurring in narrow strips derived from the shales of the lower Conemaugh formation. These cap the ridges of sufficient elevation to include the Conemaugh.

In the glade district the Dekalb silt loam occupies smooth, hilly, ridgy areas. Around Cowen the ridges are low, but they increase in height in all directions from that place. Most of the slopes are long and smooth, but the higher ridges near the crests rise rather sharply to narrow tops. The position of the Dekalb silt loam insures good surface drainage. In fact the run-off is so rapid that the slopes wash and gully badly, unless care is taken in cultivation. The somewhat compact subsoil retards internal drainage, also prevents the capillary rise of moisture, and in dry periods crops may suffer for moisture.

The Dekalb silt loam is an important soil agriculturally, especially in the Cowen and Camden or Gauley districts. Most of the type is cleared and devoted to cultivated crops or to grass. The timber growth consists of oak, chestnut, beech, walnut, maple, and willow. The areas on the ridge or mountain crests, while comparatively more desirable than the stony slopes, are often difficult to reach on account of the steepness of the slope and the expense of building roads.

Corn is the principal cultivated crop. The yields range widely, from 15 to 60 bushels to the acre. Oats constitute the most important small grain. The crop is usually cut and fed in the sheaf. The yield of grain ranges from 15 to 40 bushels per acre. Some wheat is grown, and fair yields are obtained. A small acreage is devoted to rye. Buckwheat does well, and is especially suited to the higher elevations. This is not a strong grass soil, but fair yields of timothy, redtop, and orchard grass are obtained. Some clover is grown, and the crop gives good results when the soil is limed. During the late summer the pasturage on this soil becomes scant, especially if the rainfall is deficient. The pasturage would be better if the land were reseeded more frequently. Potatoes grown on this type are of excellent quality, but the acreage on each farm is small. The yield ranges from 50 to 100 bushels per acre.

On the higher ridge crests the elevation is rather high for corn, and these areas are better suited to the production of buckwheat,

potatoes, and grass. The small grains on these areas are apt to winterkill, as the wind removes the protective covering of snow.

Practically the only fertilizer used on this soil is the small amount of manure produced in the stables and barnyard. On farms near the railroads small amounts of commercial fertilizers are applied.

The price of this land varies not only with the location and natural productiveness, but with the number and thickness of the underlying coal seams. The surface rights of desirably located farms probably average about \$50 an acre.

This soil could be much improved by incorporating organic matter. Applications of barnyard manure should be made and cover crops plowed under. Rye would be an excellent winter cover crop, while for summer the mere growing of legumes, such as cowpeas and soy beans, would do much to increase the productiveness. The soy bean should do especially well in this climate.

UPSHUR STONY SILTY CLAY LOAM.

The Upshur stony silty clay loam, to a depth of 5 to 8 inches, is a silty clay loam or heavy clay loam to silty clay. Where not subjected to much washing or erosion the soil is of the more silty character; with the removal of the surface soil on cultivated slopes the heavier underlying material is brought to the surface, making the soil more clayey. The color varies from dark brownish red to Indian red. The subsoil is an Indian-red, stiff, smooth, tough clay, with a very greasy feel. The lower part usually contains more or less disintegrated shale, which is either dark red or greenish in color. The subsoil extends to depths varying from 10 or 12 inches to more than 36 inches, the underlying shales or red sandstones being near the surface on steep slopes.

Included in the type as mapped are small areas having a gray surface soil with a yellow subsoil, representing material of the Dekalb series. Such soil is either derived from a gray sandstone and shale stratum in the red shale formation, or represents land-slips from the Dekalb material higher up the slope. Also places frequently occur where the soil mass is a mixture of Dekalb and Upshur materials.

Fragments of red and gray sandstone and red shale are scattered over the surface and in the soil mass. The gray sandstone is generally stony talus from the formation lying above the Mauch Chunk. The rock fragments vary in size from small pieces to boulders. Quite commonly the more stony areas consist of strips up and down the slopes, the stones evidently coming from higher lying outcrops. On parts of the slopes where the gradient is less steep the quantity of stone is not great enough to interfere with cultivation, but the extent of this less stony soil is not sufficient to warrant separation on the soil map.

The Upshur stony silty clay loam occupies an area of 7,232 acres. The type is mainly confined to the valley of the Elk River, forming practically continuous strips on both sides of the stream from a point a few miles below Webster Springs to the county boundary at Whitaker Falls. It also extends a few miles up the Back Fork of Elk River, and up Bergoo and Leatherwood Creeks, two of the larger tributaries entering the Elk River from the south.

The type occupies the lower slopes of the valley 500 to 600 feet above the valley floor. Except where tributaries enter the Elk, these slopes are steep and they are for the most part smooth, though broken by the valleys of the affluent streams. They are also gullied in places and have an uneven surface resulting from land slips.

The run-off is rapid and surface drainage excessive, and though the material is heavy and the internal movement of moisture slow, the soil dries out hard and cracks, losing its moisture quickly, so that in ordinary dry periods crops soon suffer from drought.

The Upshur stony silty clay loam is considered the most productive and the most desirable of the upland soils, although it is the hardest to handle. The greater part of the type is cleared, and either in cultivated crops or in grasses for hay and permanent pasture. The original timber growth was thick, and the trees large. Poplar, walnut, butternut, hickory, beech, maple, locust, and wild cherry were the principal species.

Corn, the most important crop, gives good yields in seasons of well-distributed rainfall. Small grains are likely to be damaged by winter killing, as the soil has a tendency to heave, but otherwise they do well. This is the best grass soil in the county, as it is somewhat calcareous. Timothy, redtop, orchard grass, and clover are grown. The most extensively grown hay crop consists of timothy and clover mixed. Bluegrass forms a durable sod in areas that do not wash. Good permanent pastures can be obtained by removing the timber and brushy growth and sowing bluegrass.

This soil is heavy and difficult to handle. It must be plowed when in the proper moisture condition in order to obtain a satisfactory seed bed. If plowed when too dry it breaks into clods which are hard to reduce, and if when too wet it puddles and bakes. Its position on steep slopes prevents the use of the most efficient farm implements, and much of the cultivation is necessarily done with the hoe.

All the barnyard manure available is applied to the fields, but the supply is entirely inadequate. The prevailing method of rotating the cultivated crops for hay and pasture helps to maintain the supply of organic matter. Very little commercial fertilizer is used.

The average price of land of this type is about \$50 an acre. The farms usually include some land of lower value lying higher up on the slopes, and possibly some better bottom land.

In farming this soil care should be taken to prevent erosion by terracing or by alternating different crops in strips across the slopes. To improve the tilth and increase the supply of organic matter, in which the soil is deficient, effort should be made to grow and plow under cover crops, especially the legumes. Growing winter cover crops to protect the soil is recommended. Applications of lime would be beneficial in improving the physical condition of the soil.

POPE SANDY LOAM.

The Pope sandy loam, to a depth of 8 or 10 inches, consists of a light-brown or grayish-brown sandy loam, varying from medium to fine in texture. The subsoil is a light-brownish to yellowish sandy loam of the same texture as the surface soil and extends in most places to a depth of more than 36 inches. Along the smaller streams, and at stream junctions, there is often considerable gravel or large cobbles present either beneath the surface material at slight depth, or, as frequently occurs, the entire mass may be made up of sand, gravel, cobbles, and boulders. This latter condition represents Riverwash, and the areas would be separated on the map if of sufficient extent. While the color typically is yellowish to brown, there are some reddish areas, occurring where material has been derived from red shales or from the Upshur soils farther up the stream. Such red soil is found along the Back Fork of Elk River, and Gauley, Williams, and Cranberry Rivers. The texture varies along different parts of the streams. Where the streams are narrow and along their upper courses the material is coarser, and along the banks and on bars may be a loose sand or loamy sand. Along the larger streams the texture is ordinarily a fine sandy loam, and in a few patches, mostly along the Gauley and Williams Rivers, the texture is a loam or silt loam.

The Pope sandy loam occurs in all the stream valleys, except that of the Elk River. The areas are narrow and not always continuous, being pinched out in canyonlike sections of the valley. While the total area of the type is not large, it is so widely distributed that most of the valley farms include at least a small acreage of it. The type is most extensive along the Williams River. It is a first bottom type, but includes some low terraces which are subject to inundation at times of high water. The surface is flat, though marked by channels cut by the stream during floods. The elevation above the streams ranges from 1 to 2 feet to 10 or 15 feet.

With the exception of small depressions the Pope sandy loam is well drained.

This type was among the first to be farmed, and owing to the absence of stones, the level surface, the mellow character of the soil,

and its productiveness, practically all of it has been cleared and placed under cultivation. Formerly it was heavily timbered, largely with walnut, butternut, hickory, beech, maple, poplar, and sycamore. Corn, hay, and potatoes are the leading crops. Corn does well, yielding 25 to 60 bushels per acre. Small areas on all farms are devoted to potatoes. Part of the type is kept in grass, for hay and permanent pasture, though this is not a strong soil for grasses, the yield of hay averaging less than 1 ton per acre. Garden vegetables do well. The manure produced is applied to the soil, and on some farms light applications of commercial fertilizers are made.

The price of land of the Pope sandy loam ranges from \$25 to \$100 an acre, depending upon the location and productiveness.

MOSHANNON FINE SANDY LOAM.

The Moshannon fine sandy loam, to a depth ranging from 8 to 12 inches, consists of a brownish or Indian-red fine sandy loam, underlain by a brick-red or Indian-red fine sandy loam similar in most respects to the surface soil, but usually somewhat more compact. The type includes some areas with a brownish surface soil and a brownish or slightly reddish subsoil, representing the Pope sandy loam. It also includes some strips or bars of rather loose fine sand or loamy fine sand. The soil on the banks along the stream is a little sandier than typical, and gravel and cobble beds are sometimes encountered within 3 feet of the surface. Where tributary streams enter the valley there occur fans of gravelly and cobbly material, which if of sufficient extent would be mapped as Riverwash.

The Moshannon fine sandy loam is confined to the bottom lands of Elk River, where it has been formed from the deposition of red soil material washed from the red shale and sandstone occurring on the valley slopes.

The surface is flat except for slight undulations due to the formation of sand bars or the cutting of troughs by flood waters. The type lies 2 to 10 feet or more above the normal level of the streams. Despite the low position the soil is fairly well drained.

While of small extent, the Moshannon fine sandy loam is an important soil type. It is all cleared and under cultivation. Corn and hay are the principal crops. The average yield of corn is somewhat higher than on the Pope sandy loam. As much as 100 bushels of corn per acre has been produced, but ordinarily the yield ranges from 30 to 60 bushels. This is also a better grass soil than the Pope sandy loam, the yields of hay ranging from one-half to 1 ton or more to the acre. Potatoes and garden vegetables do well. Practically the only form of fertilizer used is barnyard manure. Near the railroads some commercial fertilizers are used, but the applications are light.

Land values on the Moshannon fine sandy loam range from \$30 to \$100 an acre.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Moshannon fine sandy loam:

Mechanical analyses of Moshannon fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
222001.....	Soil.....	0.2	3.9	9.2	43.8	18.5	16.5	8.1
222002.....	Subsoil.....	.2	3.5	8.0	42.5	19.0	17.3	9.8

ATKINS SILT LOAM.

The Atkins silt loam to a depth of 8 to 10 inches consists of a brownish to drabbish rather heavy silt loam, with some mottlings of brown. The subsoil to depths exceeding 36 inches consists of a drab, plastic clay, streaked with yellow. On slight elevations the subsoil may be entirely or predominantly yellow, with streaks of drab and brown.

The Atkins silt loam is confined to the southwestern part of the county, in the glade district, and is most extensively developed in the vicinity of Cowen. Its total area is small. It occurs in the first bottoms along streams, usually at or near their source. The areas are flat and poorly drained, and more or less marshy. Their occurrence is due to an underlying stratum of sandstone.

In the natural condition these bottom lands were originally wet, grassy areas, supporting in places a growth of black alder and other brush. All the areas are at the present time cleared and used as pasture or hay land. Much of the growth, especially in the better areas, consists of wild grasses and sedges. Only small areas are cultivated. These have been drained and limed. When reclaimed in this way they have proved highly productive for corn.

ROUGH STONY LAND.

Rough stony land comprises areas of massive sandstone outcrops on slopes and mountain tops, together with the stony débris below, the steep surface and abundance of stones precluding cultivation.

Areas of this character are scattered, and in the western and northern parts of the county are restricted to rock-outcrop areas at the tops of slopes or to steep slopes in the bends of streams. Along Elk River the areas are larger and in places occupy the slopes from the river to the mountain tops. The largest areas lie in the southeastern part of the county, extending from the slopes continuously over the mountain tops. The type includes some less stony patches or even

small bodies of Dekalb silt loam, whose separation on the map is impracticable.

The Rough stony land supports the typical forest growth of the county. In the ravines there is a large amount of hemlock, while on the high mountain areas in the southeastern part of the county there are spruce or pine forests.

SUMMARY.

Webster County, W. Va., is situated near the geographical center of the State. It comprises an area of 558 square miles, or 357,120 acres.

The county lies in the Allegheny Plateau region, near its eastern border. The topography is mountainous. The elevation above sea level ranges from 950 feet along the stream valleys on the western side of the county to nearly 4,000 feet on the higher crests on the eastern and southeastern borders.

All the drainage of Webster County reaches the Ohio River. The principal streams within the county are the Little Kanawha, Elk, Gauley, Williams, and Cranberry Rivers. These rivers and their tributaries are swift-flowing mountain streams.

Permanent settlement of this region was begun soon after the Revolutionary War, by immigrants from more eastern sections of the country. The population of Webster County in 1910 was 9,680, all of which is classed as rural by the census. Webster Springs is the county seat.

The Richwood Branch of the Baltimore & Ohio Railroad passes through the western part of the county. The West Virginia Midland Railway connects this road from Holly Junction with Webster Springs. There are a number of lumber railroads in the county.

Webster County has a cool, temperate climate, well suited to the production of crops that do not require a long growing season. The mean annual temperature is about 49° F. and the mean annual rainfall about 61 inches.

Agriculture in this county consists of general farming combined with some stock raising. The products of the farm barely meet the local demands. Corn and hay are the principal crops, followed by the small grains, of which oats are the most important. Potatoes and buckwheat are grown on most farms, and every farmer produces garden vegetables. Cattle and sheep raising are the principal live-stock interests. The cattle are produced for beef, and the sheep for both wool and mutton. The most popular breed of cattle is the Hereford. The sheep are principally coarse-wool mutton breeds.

Farms occupy about 29.2 per cent of the area of Webster County, according to the census of 1910. The average size of the farms in that year was 100.6 acres, of which 35.2 per cent was classed as im-

proved. Large tracts of timber land are still held by individuals and corporations, and lumbering is the leading industry of the county.

The soils of Webster County fall into two classes, residual and alluvial. Excluding Rough stony land, six soil types are recognized. The residual soils, classed in the Dekalb and Upshur series are derived from sandstone and shale of Carboniferous age. The Dekalb silt loam and stony silt loam are characterized by a gray or light-brownish surface soil and a brownish-yellow to yellow subsoil. They are derived from gray sandstones and shales. The Upshur stony silty clay loam, characterized by brownish-red to dark or Indian red surface soil and subsoil, is derived from red shales and sandstones. It is a heavy soil and the most productive of the upland types.

The alluvial soils are classed in the Pope, Moshannon, and Atkins series. The Pope sandy loam, the most widely distributed bottom soil in the county, is characterized by a brownish-gray surface soil and a brownish-yellow subsoil.

The Moshannon fine sandy loam has a brownish-red to red surface soil and a dark-red or Indian-red subsoil. It is confined to the Elk River bottoms.

The Atkins silt loam is a poorly drained bottom soil occupying the "glade" district of the county. It has a brownish to drab-colored surface soil and a drab subsoil streaked with yellow.



[PUBLIC RESOLUTION—No. 9.]

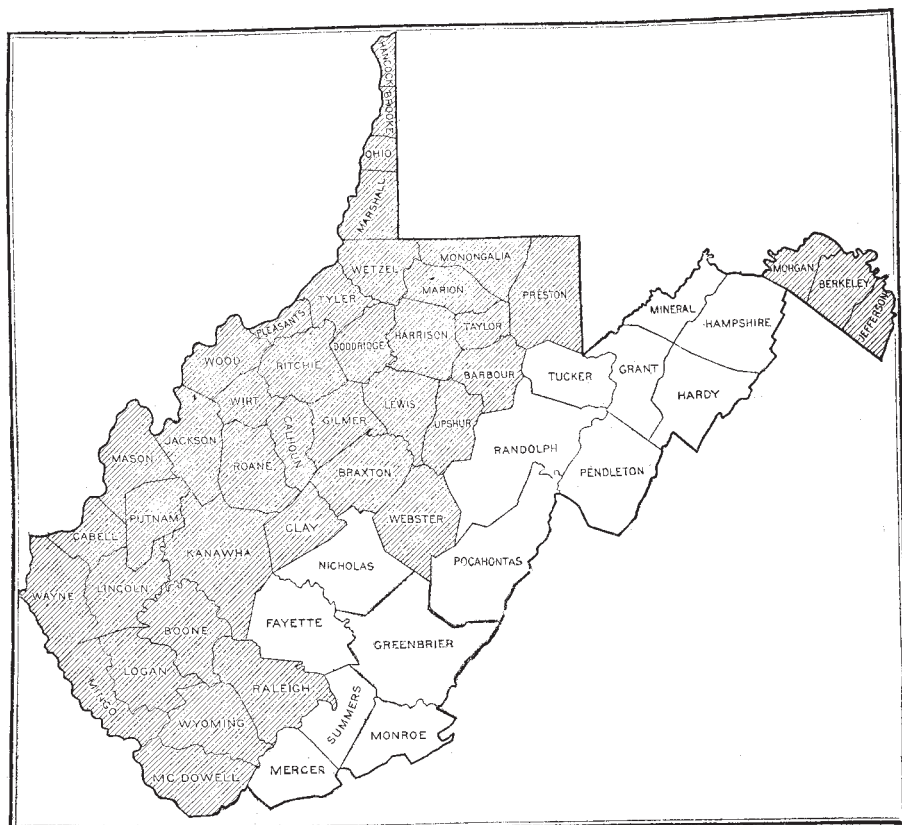
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



Areas surveyed in West Virginia.

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